WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device, the method comprising:
forming a wafer containing inlaid copper (Cu) or a Cu alloy;
treating an exposed surface of the Cu or Cu alloy to remove oxide therefrom;
depositing a silicon nitride capping layer on the treated Cu or Cu alloy; and
laser thermal annealing the deposited silicon nitride capping layer.

2. The method according to claim, comprising treating the exposed surface of the Cu or Cu alloy with a plasma containing ammonia (NH_3) at a temperature of about 250°C to about 320°C to remove copper oxide therefrom.

3. The method according to claim 2, comprising depositing the silicon nitride capping layer by plasma enhanced chemical vapor deposition (PECVD) at a temperature of about 250°C to about 320°C.

4. The method according to claim 3, comprising laser thermal annealing the deposited silicon nitride capping layer in nitrogen (N_2) at a temperature of about 420°C to about 480°C.

5. The method according to claim 4, comprising:
depositing the silicon nitride capping layer at an as deposited first density; and
laser thermal annealing the deposited silicon nitride capping layer to increase its density to a second density greater then the first density.

6. The method according to claim 5, comprising laser thermal annealing the deposited silicon nitride capping layer to increase the first density by about 5% to about 8%.

7. The method according to claim 6, comprising laser thermal annealing the deposited silicon nitride capping layer to increase its density to the second density of about 2.67 to about 2.77 g/cm^3.

8. The method according to claim 4, comprising laser thermal annealing by impinging a pulsed laser light beam on the deposited silicon nitride capping layer at a radiant fluence of about 0.114 to about 0.130 $joules/cm^2$.

9. The method according to claim 1, comprising depositing the silicon nitride capping layer by plasma enhanced chemical vapor deposition (PECVD) at a temperature of about 250°C to about 320°C.

10. The method according to claim 1, comprising laser thermal anneal the deposited silicon nitride capping layer in nitrogen (N_2) at a temperature of about 420°C to about 480°C.

11. The method according to claim 1, comprising:

depositing the silicon nitride capping layer at an as deposited first density; and

laser thermal annealing the deposited silicon nitride capping layer to increase its density to a second density greater than the first density.

12. The method according to claim 11, comprising laser thermal annealing the deposited silicon nitride capping layer to increase its density to the second density of about 5% to about 8% greater than the first density.

13. The method according to claim 12, comprising laser thermal annealing the deposited silicon nitride capping layer to increase its density to the second density of about 2.67 to about 2.77 g/cm_3.

14. The method according to claim 1, comprising a laser thermal annealing by impinging a pulsed laser light beam on the deposited silicon nitride capping layer at a radiant fluence of about 0.114 to about 0.130 joules/cm^2.

15. The method according to claim 1, wherein:

the wafer contains a dual damascene structure comprising a Cu or Cu alloy line in contact with an underlying Cu or Cu alloy via or contact formed in a dielectric layer; and

the dielectric layer comprises a material having a dielectric constant less than about 3.9.